

Analysis of Moisture and Fat in Chips Using the FAST Trac

Introduction

Time Domain NMR (TD-NMR) is a technology ideally suited for the measurement of moisture and fat (oil) in chips. This technology works by exploiting the differences in NMR relaxation rates between solids and bound moisture (rapid relaxation) and oil (slow relaxation). Because moisture is tightly bound in chips, the signal due to moisture can be readily distinguished from the signal due to fat.

Unlike other rapid methods, NMR obtains a signal from the entire sample (not just the surface), which ensures representative sampling and the most accurate results.

Calibration is quick, easy, and highly robust. Calibration is done through simple linear regressions (no multivariate techniques required) and only a handful of samples are needed to create new calibrations. Calibrations are insensitive to additives and are not affected by sample granularity or color.

FAST Trac

The FAST Trac is a newly developed product featuring the ability for rapid testing (less than 2 minutes) in a small footprint and with an easy-to-use touch screen interface. With intuitive software, the instrument is remarkably easy to operate...you don't have to be experienced in chemometrics or spectroscopy to obtain accurate and reliable results.



**Heater block and external balance not shown.

Key Features and Benefits:

- 2-minute analyses using new QuikPrep™ Technology (Patent Pending) for rapid sample conditioning
- IFM™ Technology (Interference-free moisture) for reliable moisture determinations regardless of fat concentration
- More accurate and robust than NIR
- Accuracy comparable to standard methods
- Calibrations are simple to create, and are insensitive to additives, sample color, and granularity
- Intuitive software and easy-to-use touch screen interface

Method Development

To demonstrate the potential of the *FAST Trac* for the analysis of chips, a moisture and fat method was created using only 3 samples selected to span the component ranges of the 11 available samples. The samples were obtained from a local supermarket and ground before analysis. Reference values were obtained using standard methods (acid hydrolysis and oven drying). The calibration lines are shown in Figures 1 – 2.

To complete each analysis, the sample was weighed on a glass fiber pad, rolled up in Trac film and inserted into a Trac tube. The samples were conditioned in 45 seconds using QuikPrep™ Technology, and then inserted in the magnet for analysis. For batch analyses, it is recommended that samples be conditioned for at least 30 minutes on a heater block set at 40 °C. Once inserted in the magnet, analysis is complete within 1 minute.

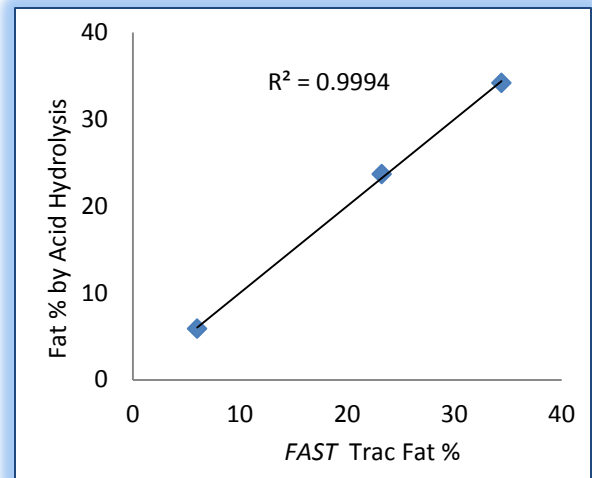


Figure 1: Fat calibration

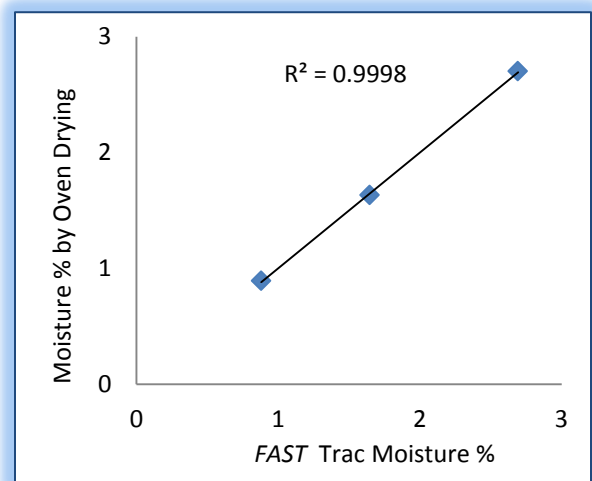


Figure 2: Moisture calibration

Results

To illustrate the accuracy obtainable using moisture and fat methods created with only 3 reference points, the remaining 8 samples were run on each of the methods. The average accuracies for the unknown samples (5 replicates each) are shown in Table 1, below. The accuracy and repeatability for each sample are shown in Tables 2 – 4. The overall errors are comparable to those inherent in the reference methods. These results suggest that using only a single calibration, the FAST Trac is able to accurately measure moisture and fat in a broad range of chips.

Table 1: Overall Accuracy

Component	Avg. Error (%)
Moisture	0.17
Fat	0.39

Table 2: Moisture Method Results

Sample	Ref. Moisture %	Repeats					Average NMR Moisture %	Std. Dev.	Error %
		1	2	3	4	5			
Baked Potato Chip – Plain	2.70	----- Calibration Sample -----							
Baked Potato Chip – Seasoning 1	1.79	1.60	1.74	1.55	1.57	1.58	1.61	0.08	0.18
Baked Potato Chip – Seasoning 2	2.57	2.18	2.27	2.33	2.35	2.37	2.30	0.08	0.27
Fried Potato Chip – Plain	2.27	2.22	2.05	1.87	1.87	2.14	2.03	0.16	0.24
Fried Potato Chip – Seasoning 1	2.45	2.26	2.36	2.42	2.39	2.46	2.38	0.08	0.07
Fried Potato Chip – Seasoning 2	2.38	2.42	2.40	2.53	2.27	2.54	2.43	0.11	0.05
Fried Potato Chip – Seasoning 3	2.19	1.93	2.09	1.98	1.98	2.01	2.00	0.06	0.19
Fried Tortilla Chip – Plain	1.63	----- Calibration Sample -----							
Fried Tortilla Chip – Seasoning 1	1.87	2.17	2.07	2.07	2.10	2.25	2.13	0.08	0.26
Fried Tortilla Chip – Seasoning 2	1.92	1.96	2.09	2.10	2.02	2.06	2.04	0.06	0.13
Fried Corn Chip - Plain	0.89	----- Calibration Sample -----							
							Average =	0.17	

Table 3: Fat Method Results

Sample	Ref. Fat %	Repeats					Average NMR Fat %	Std. Dev.	Error %
		1	2	3	4	5			
Baked Potato Chip – Plain	5.87	----- Calibration Sample -----							
Baked Potato Chip – Seasoning 1	12.47	11.75	11.47	11.98	11.96	11.68	11.77	0.21	0.70
Baked Potato Chip – Seasoning 2	11.11	11.28	11.17	11.06	11.17	11.04	11.14	0.10	0.03
Fried Potato Chip – Plain	34.15	----- Calibration Sample -----							
Fried Potato Chip – Seasoning 1	30.67	30.18	30.53	30.78	30.06	30.20	30.35	0.30	0.32
Fried Potato Chip – Seasoning 2	33.70	32.63	32.75	33.61	33.52	33.13	33.13	0.44	0.57
Fried Potato Chip – Seasoning 3	32.01	32.23	32.92	32.36	32.40	32.14	32.41	0.30	0.40
Fried Tortilla Chip – Plain	23.65	----- Calibration Sample -----							
Fried Tortilla Chip – Seasoning 1	26.40	26.89	26.87	26.81	26.99	26.79	26.87	0.08	0.47
Fried Tortilla Chip – Seasoning 2	26.15	26.40	26.42	26.33	26.54	26.01	26.34	0.20	0.19
Fried Corn Chip - Plain	34.71	34.23	33.83	34.94	34.20	34.24	34.29	0.40	0.42
							Average =	0.39	